

# Background of environmental testing standard "ISO-19683"

- From Small satellite to Lean satellite  
and Key for mass-production -

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# Once upon a time (not long ago)...

Hodoyoshi project (ほどよしプロジェクト) started 2010.

Development of Microsat (50 kg class)

Component Bender

Finding new user

Testing method



our task by Tokyo University  
IDEA and ELSA by AstroGate  
CESAT-ENV (environmental testing)

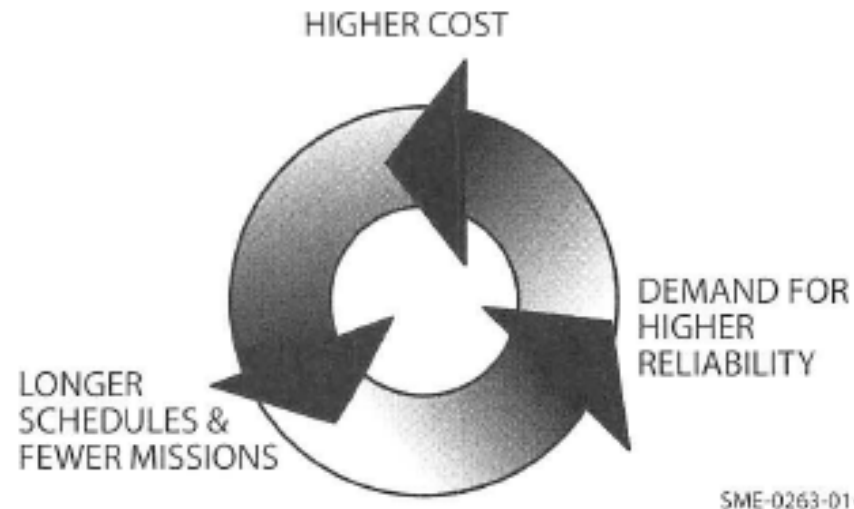


# “Hodoyoshi” = Reasonable reliability

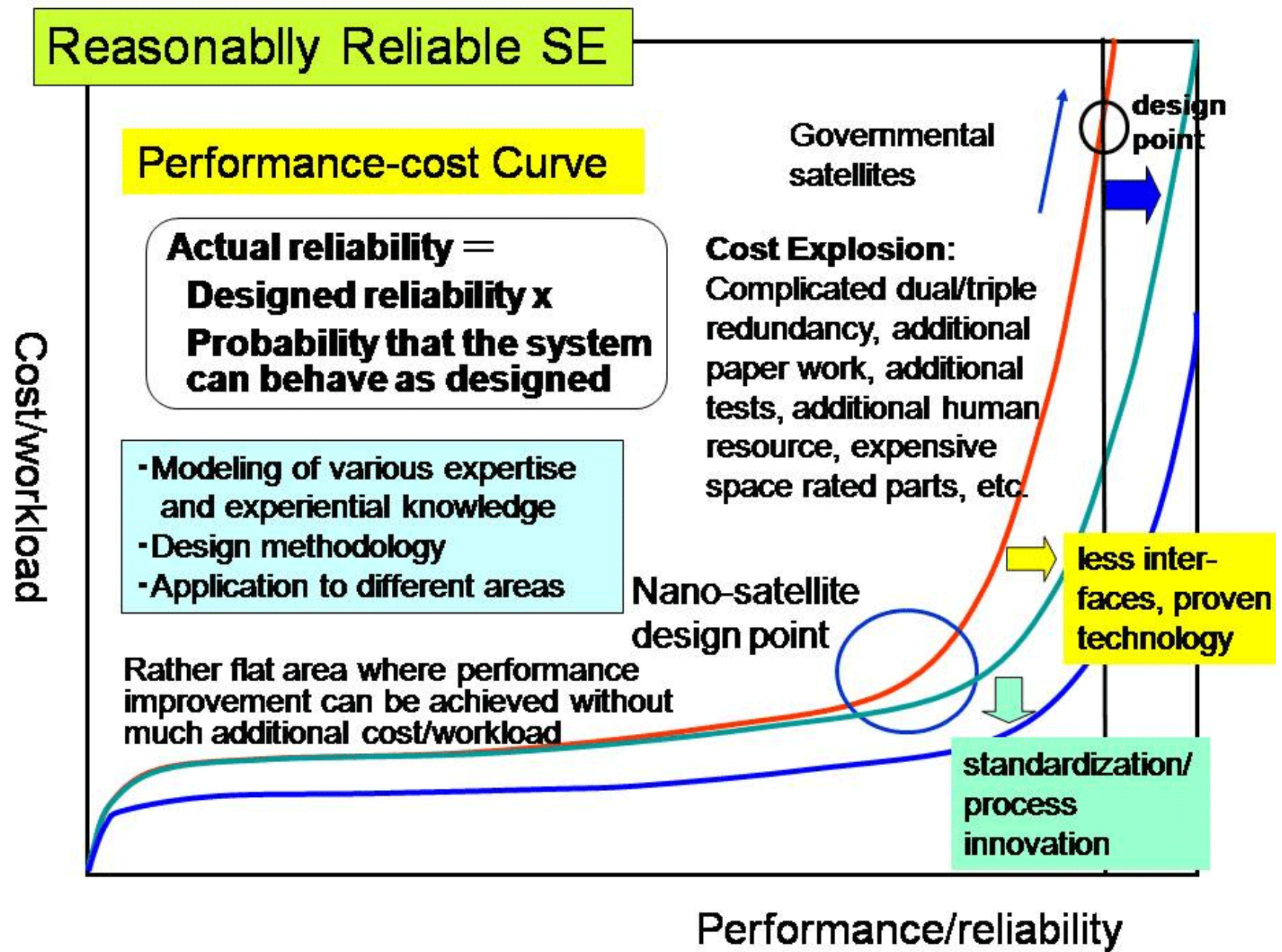
Reliability ↔ Development

Conventional development method

Increasing cost!!



**Fig. 1-2. The Space Spiral is a Significant Contributor to Increasing Costs and Longer Schedules.**



“Hodoyoshi” = Reasonable reliability

Reliability  Development

Conventional development method

→ **Suitable development method for Smallsat**

Reliability  Testing

Conventional testing method

→ **Suitable testing method for Smallsat**

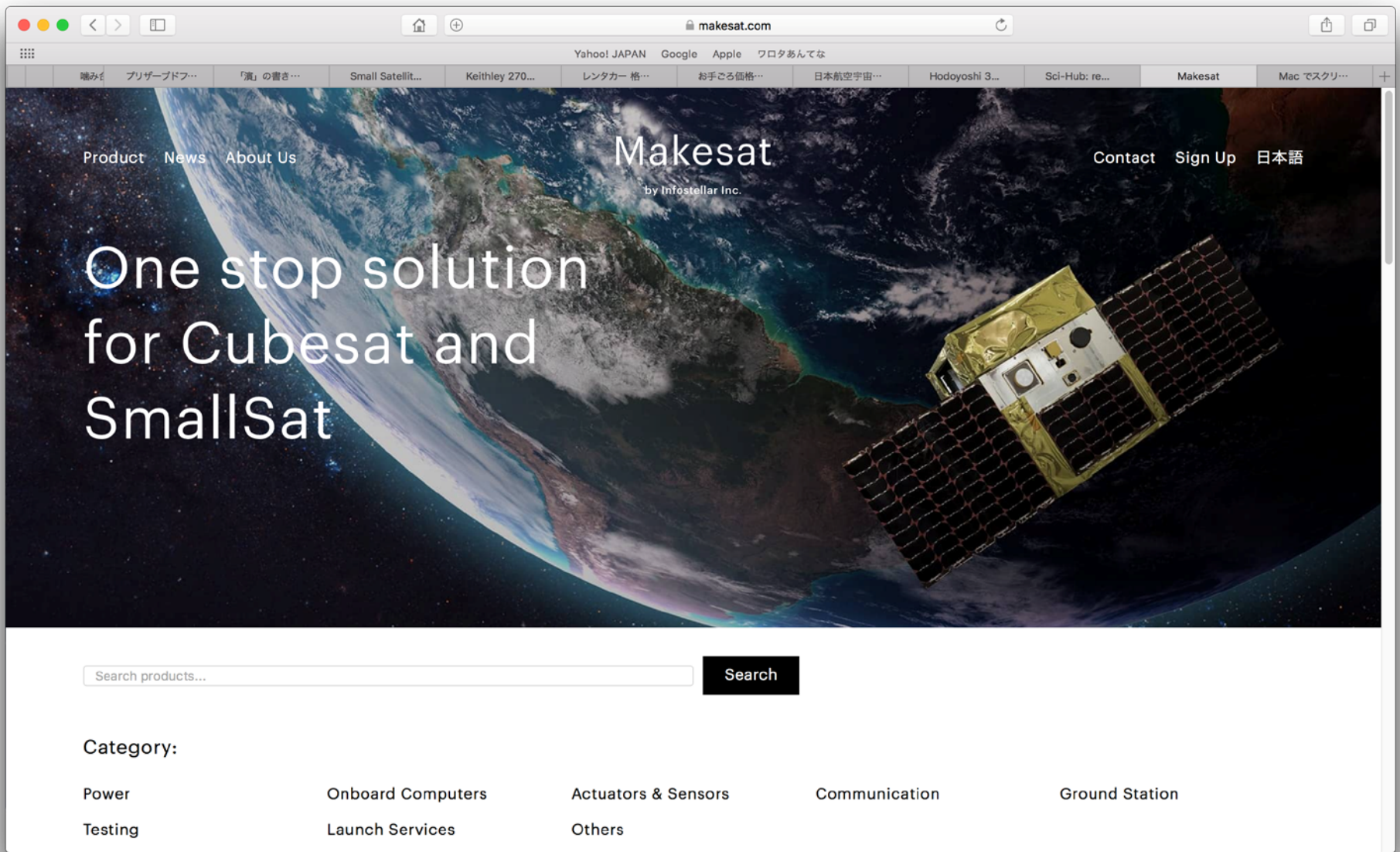
# Testing Facility “CeNT”



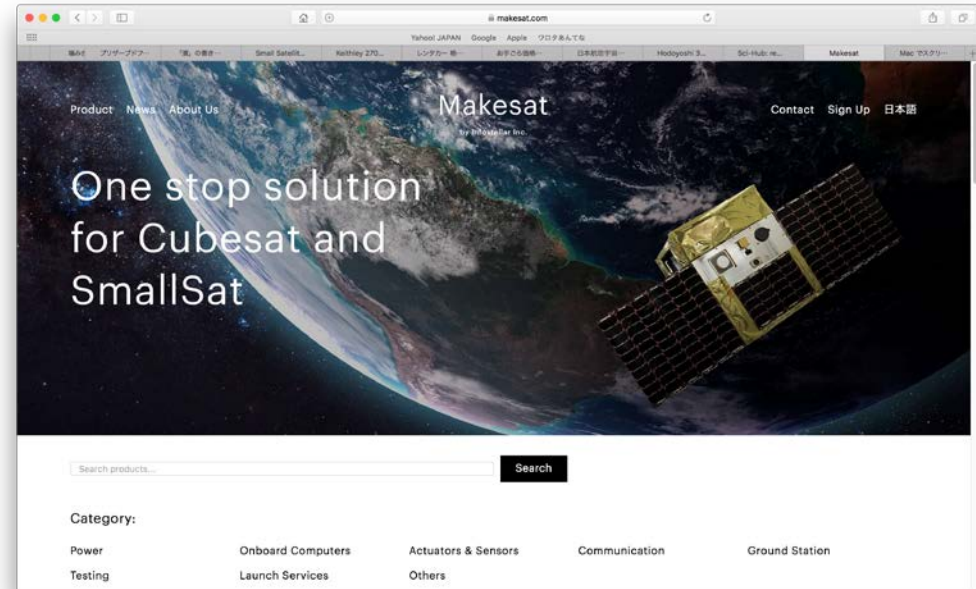
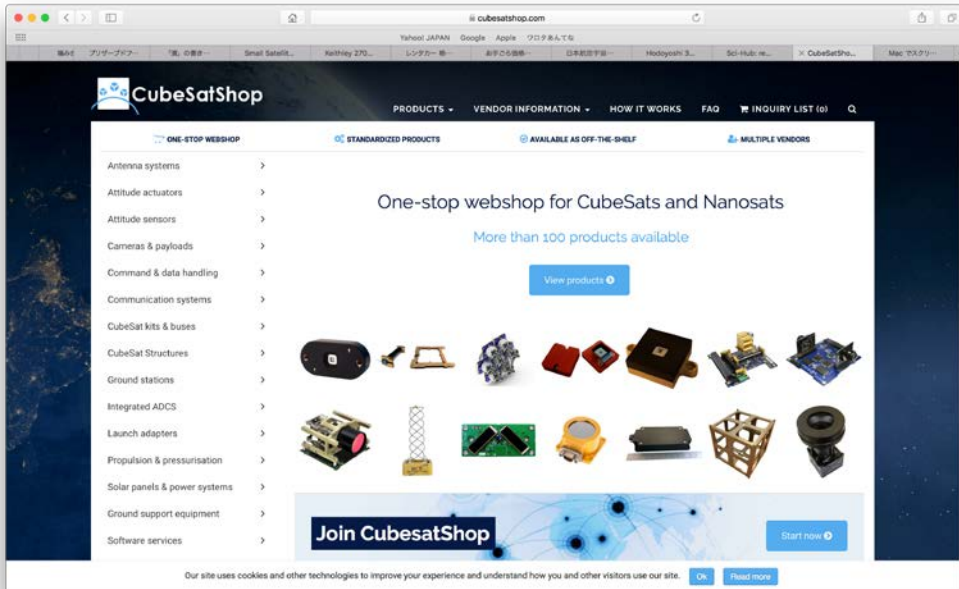
**CeNT can provide all environmental tests except for radiation test for less than 50kg satellite**



# Satellite parts on web shop



# Satellite parts shop on Web



It's time to buy the satellite components from Web shop!!



# On-line shop ...

When you buy something from Amazon

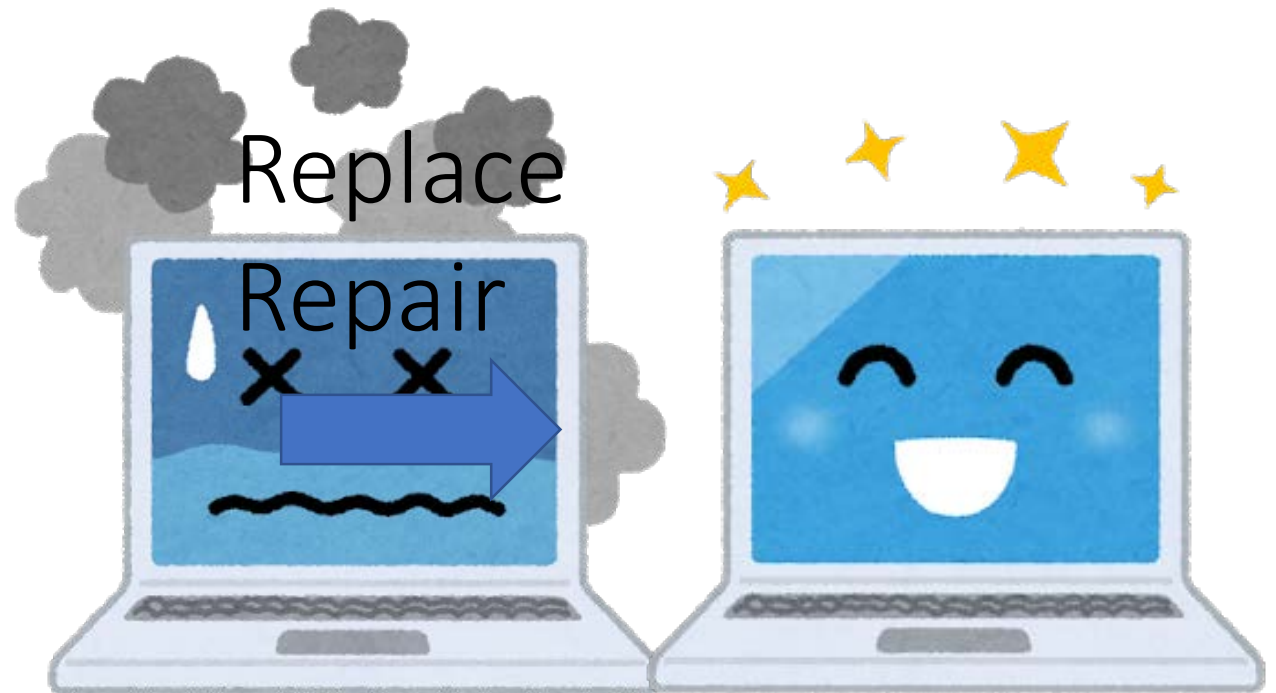
What is the most important thing for customer?



above.

# PC shop on Web

If a cheap purchased item break soon,  
most of people will be convinced.



# Satellite parts on web shop

If a purchased satellite component did not work,  
Can you convince that the purchased parts of  
the satellite were cheap?

**“NO”**

Because...

No Replace

No Repair

And

It's not cheap for small team



What is the important thing for purchasing satellite components?

**QUALIFIED**

However,  
How do we qualify  
the components?

# Necessity of standard

Customer ↔ Provider

Standard about test level and condition  
is necessary



Making consensus  
Accelerate trade

# What is “ISO-19683”?

ISO-19683

“Space systems –

Design qualification and

acceptance tests of small spacecraft and units”

This provides test methods and test requirements for design qualification and/or acceptance of small spacecraft or units. It provides the minimum test requirements and test methods to qualify the design and manufacturing methods of commercial small spacecraft and their units and to accept the final products.

# Making of “ISO-19683”

NASA, JAXA and ESA testing standard

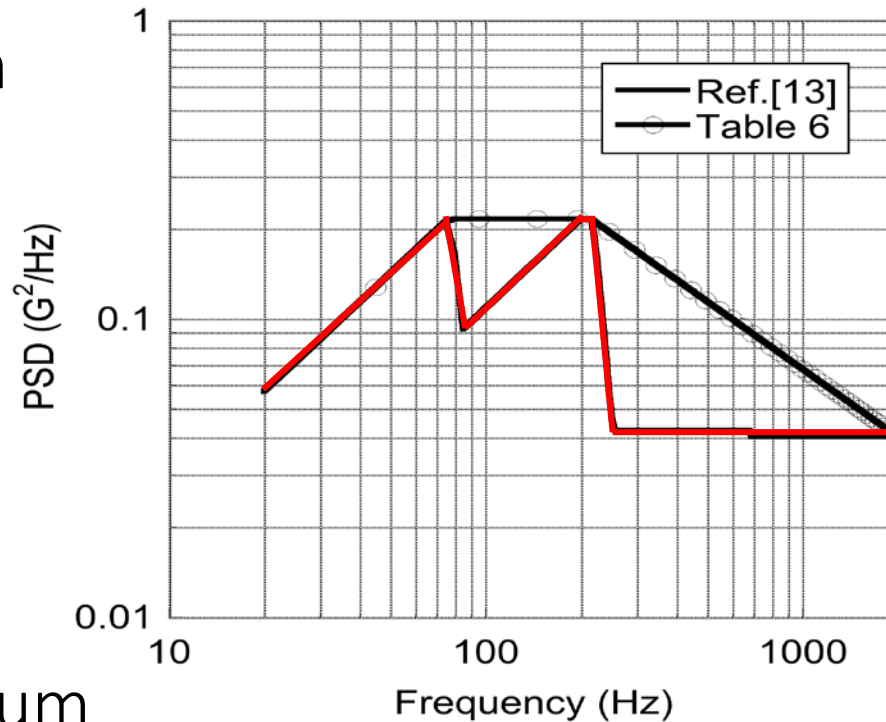
→ **Review and Pick up points**

We tested many small satellites in our facility and corrected test data

We held many workshop and discussed the contents of standard

# Detail of ISO-19683

Vibration



Thermal vacuum

|                                  |                         |
|----------------------------------|-------------------------|
| <b>Temperature range</b>         | <b>-15°C to +50°C</b>   |
| <b>Number of cycles</b>          | <b>2 or more</b>        |
| <b>Operational soak duration</b> | <b>1 hour or longer</b> |
| <b>Thermal dwell</b>             | <b>1 hour or longer</b> |

**UNIT QT**

Please buy from ISO web



# Definition of “Small”

A question from a participant was  
“What is the definition of “Small”?”

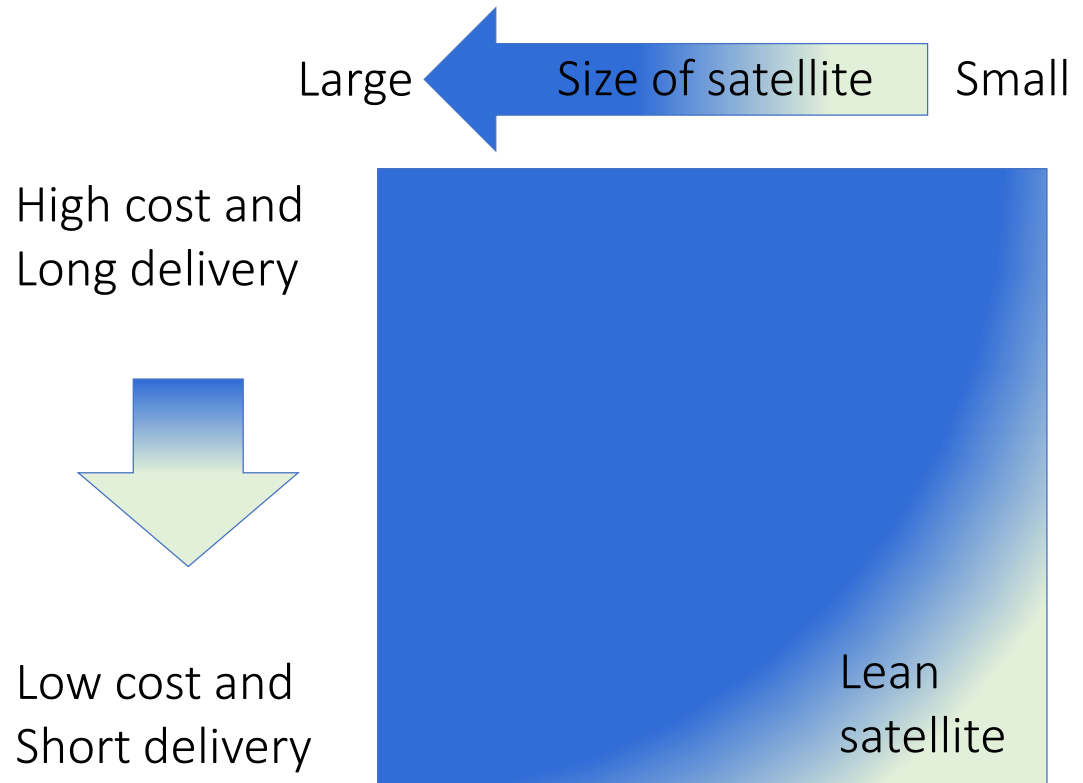
One of conclusion was  
“We don’t want to develop a small satellite  
at the first”

“As a result of cost saving and fast delivery,  
size of satellite becomes small”

The suggested word was “Lean Satellite”

# “Lean Satellite”

Using COTS parts  
Low Cost  
Fast Delivery

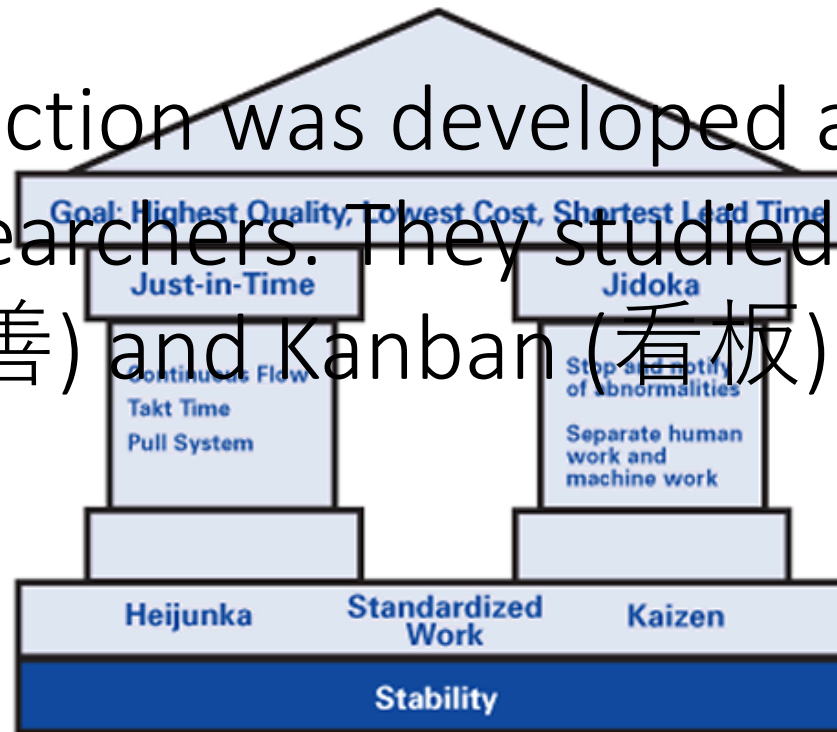


Next Lean Satellite Workshop :  
The end of 2019 or the beginning of 2020

# Lean production

Word of “Lean” originates from Lean production.

Lean production was developed and studied by MIT researchers. They studied Kaizen (改善) and Kanban (看板) by Toyota

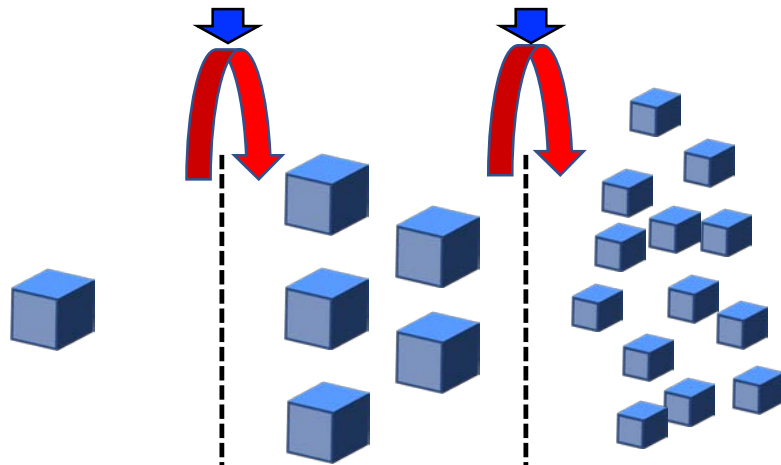


Toyota Production System "House."

<http://www.lean.org/Common/LexiconTerm.cfm?TermId=353>

# Arrival of mass production

New technology and knowledge for AIT



So far  
One make  
Exp:  
Universities

Now  
100  
satellite  
Example:  
Planet lab

Near Future  
1000  
satellite  
Example:  
One Web  
Space X

Tasks for mass-production of  
Lean satellite ( >1000 sats)

**To achieve short delivery**  
Integration

→ Simplified interface

Safety review

→ Minimize document work

**To save cost**

Vibration test

→ Shorten time of vibration test

Functional test

→ Shorten time of functional test

# Conclusion

Introduction of Background of ISO-19683

Suggestion of word “Lean satellite”

For mass production of lean satellite,  
we need to find the solution

We appreciate the efforts and contributions of many participants on the establishment of standards.

Especially, Dr. Graziani Filippo  
and Prof. Jordi Puig-Suari

Thank you for listening!!

ご静聴ありがとうございました。